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Preface

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The present volume contains the proceedings of the 2005 Twente conference on Lie groups held from 7–9 December 2005 at the campus of the University of Twente. The conference also served as the kick-off meeting for the Dutch-Russian cooperation program "Geometric Aspects of Quantum Theory and Integrable Systems" supported by NWO and RFBR under the project number 047.017.015, and that explains the strong presence of themes from this project.

An important topic within the above-mentioned project form the geometric properties of the WDVV-equations and their generalizations. The first contribution provides new solutions to these equations from a six dimensional Seiberg-Witten theory and a generalization to families of bi-elliptic curves. Both the non-linear equations satisfied by the prepotentials and the curves in these families relate to infinite dimensional integrable hierarchies.

Examples of such hierarchies occur in the second contribution, where a geometric characterization is given of a generalization of the analogues of the Gelfand-Dickey hierarchy and the AKNS-hierarchy within lower triangular Toda-hierarchies.

New integrable finite-dimensional Hamiltonian systems are being constructed in the third paper. Starting from a finite-dimensional Lie algebra and certain 2-cocycles on them, a class of quasigraded Lie algebras is constructed that admit the Kostant-Adler-Symes scheme and this yields these systems.

The class of algebraically integrable systems is also represented in this volume: the fourth contribution discusses the quantization of the birational correspondence between the Hitchin and the Beauville-Mukai systems and gives a relation with the elliptic algebras of Sklyanin, Feigin and Odesskii.

As many other areas integrable systems often benefit from the properties of special functions. The next two contributions are a nice illustration of how techniques and considerations from integrable systems theory lead to properties and relations of specific special functions. The first paper gives formulas for the computation of the zeros of a class of Legendre

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functions out of the scattering theory of certain one-dimensional Schrödinger equations and the second presents on the basis of analysis of the eigenvalue problem for identical Bose particles on the circle a number of conjectural discrete orthogonality relations for Hall-Littlewood polynomials and verifies them in a number of cases.

Part of the research in the project concerns the geometric structure of relevant equations from mathematical physics. Here the notion of covering plays a central role and enables you to describe phenomena like nonlocal symmetries, Bäcklund transformations and deformations of nonlinear equations. The contribution of O. Morozov describes how for certain equations coverings can be obtained from invariant combinations of the Maurer-Cartan equations of their symmetry Lie pseudo-group.

Symmetric spaces and their associated representations play a role in quantization and quantum field theory and as such form part of the project. The notion of canonical representation on a Hermitean symmetric space was introduced with that in mind and was extended in a natural way by Molchanov. The forelast paper discusses for Lobachevsky spaces this wider class of representations and its related intertwining operators. The accessibility of the fine structure of symmetric spaces enhances if computer packages can be used to make computations. The last contribution offers such an opening by deriving algorithmic formulas for expressing the characters of the weight lattice of the symmetric space in terms of characters of the weight lattice of the group.

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Finally I like to express my gratitude to the editor for offering the possibility to publish the proceedings of our conference as an special issue of Acta Mathematicae Applicandae.